

# ***Strategic Analysis of Naval Force Structure***

**DoD Force Structure Analysis Way Ahead  
WG 5: “Analytic Tools and Data for Force Structure Analysis”**

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# ***Strategic Analysis of Naval Force Structure***

- ◆ **Why Strategic Analysis (long range business planning)?**
  - Why force structure is important to the Navy
  - Nature of the problem: the force structure challenge and strategic planning context
  - Planning Phases to Strategic Force Analysis Methodology (phases & fidelity are important)
  - Phases and Components with driving factors addressing capacity, warfare areas, & capability
- ◆ **The Phases and Sufficiency Analysis**
  - Phase definitions identifying objectives and products
  - Sufficiency analysis process, driving factors, and warfare areas
- ◆ **Tools and Models**
  - ForceSAM construct and analysis toolkit
  - Shipbuilding (FAIM); fleet capacities (XPI) module; MMR module; Shipyard Loading module
  - Other: Fleet Affordability Tool, Fleet Design & Presence Model; FFAN capability module
- ◆ **Summary and Take-Aways**

# Why Strategic Analysis?

## ♦ Why strategic analysis of Naval force structure

- Global and National Uncertainty and Change
  - US roles in World and DoD Mission – Transnational Threat & Terrorism
  - Transformation Opportunity for Change
- Support DoD Analytical Agenda and Naval strategic guidance (maritime strategy, etc.)

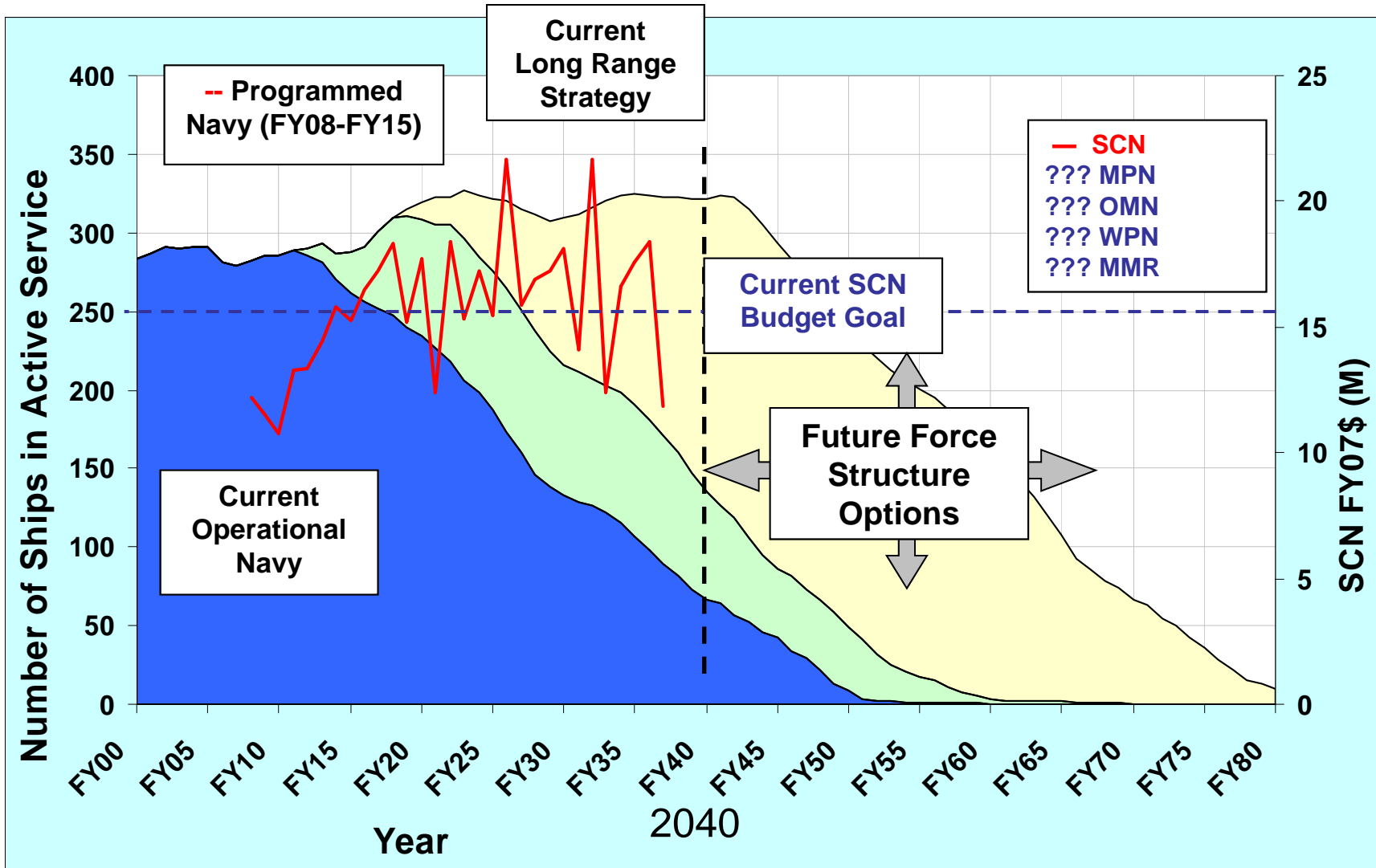
## ♦ Why important to Navy

- Ships are Unique & Need Long-Term Focus
  - 10 years for concept to production & 30-50 years for production through operation
  - Ships are complex, Integrated Warfare Systems & components of an integrated force architecture
- Support OSD/Navy customers in examining and developing robust alternative Ship Acquisition Strategies and resulting force structures and ultimately analysis trade space for senior leadership
  - Analysis Develops Multiple Fleet Options For Evaluation & Comparison
  - Balancing cost, capability, and industrial base. Assessing resulting risk and defining trade space
  - Shipbuilding plan, technology commitments, current programs v. future investment
- A Need for Analytic Rigor -- develop and operate analysis tools and integrated environment
  - Analysis toolkit of legacy Force Structure and Affordability models
  - Force Level design tools and capability assessments
  - Broad, consistent, and integrated treatment of information & tools
  - Maintain shipbuilding plans & databases for technology, combat systems, and ship concepts

*Influence Naval Force Structure (what we buy, how many, & capability delivered)*

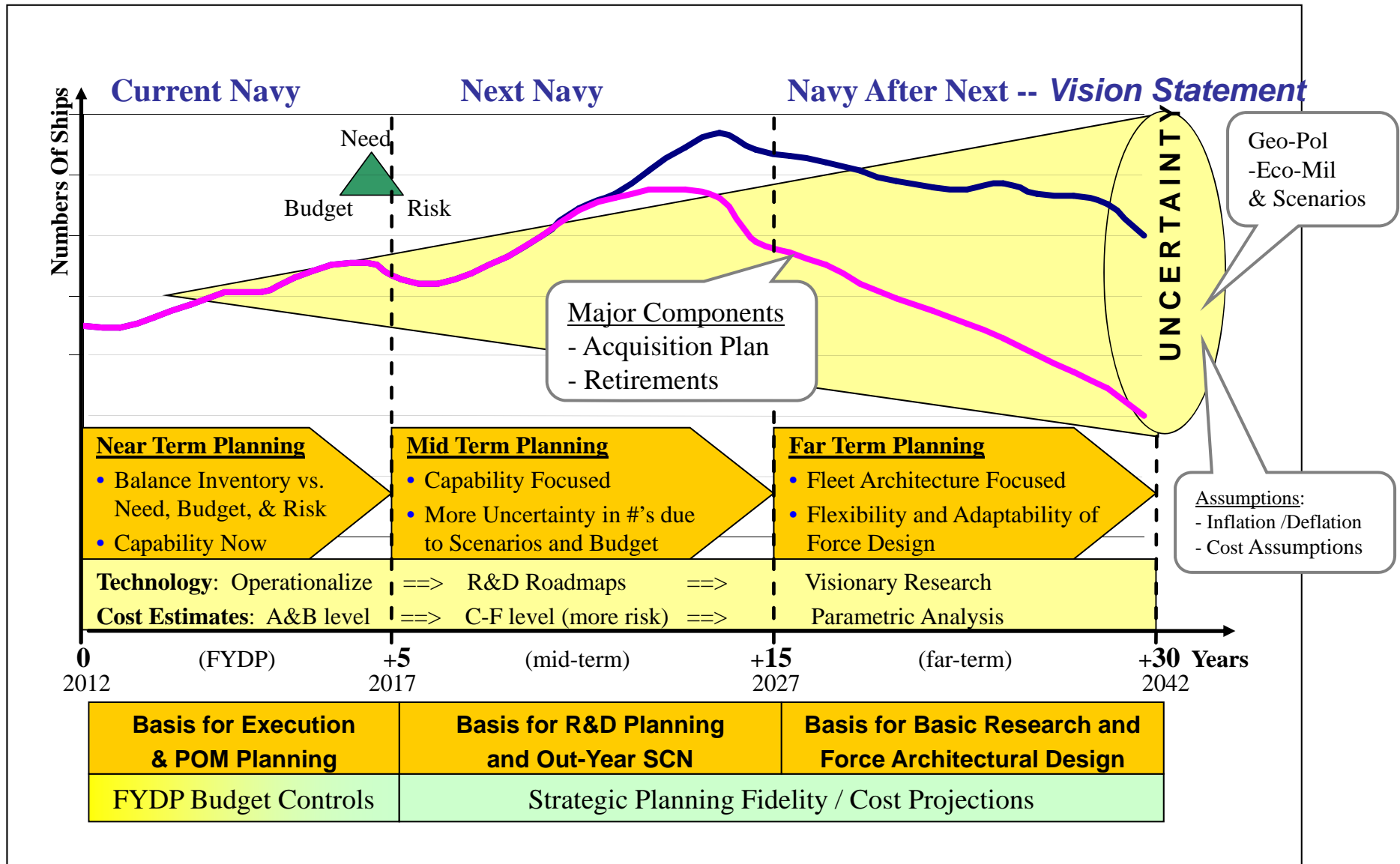
# Force Structure Challenge

## Naval Ships

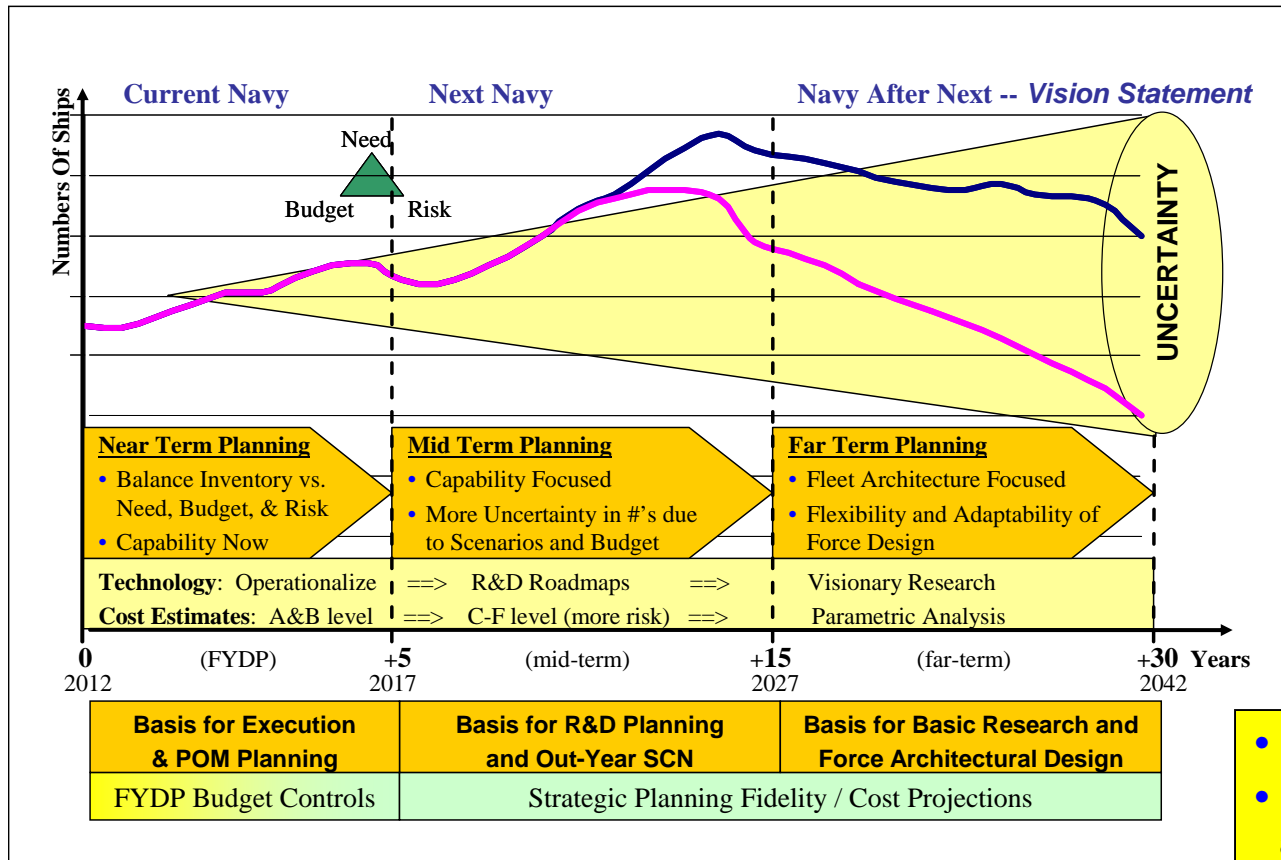


**15-20 Years for Significant Force Level Operational Impact**

# Strategic Planning Context



# Strategic Force Analysis: Four Phases



## (1) Futures & Design Guidance

Establishes design vision and future world context.

## (4) Strategy Assessment

Provides long-term force design insights to decision makers  
Evolving futures and force designs

## (2) Force Design

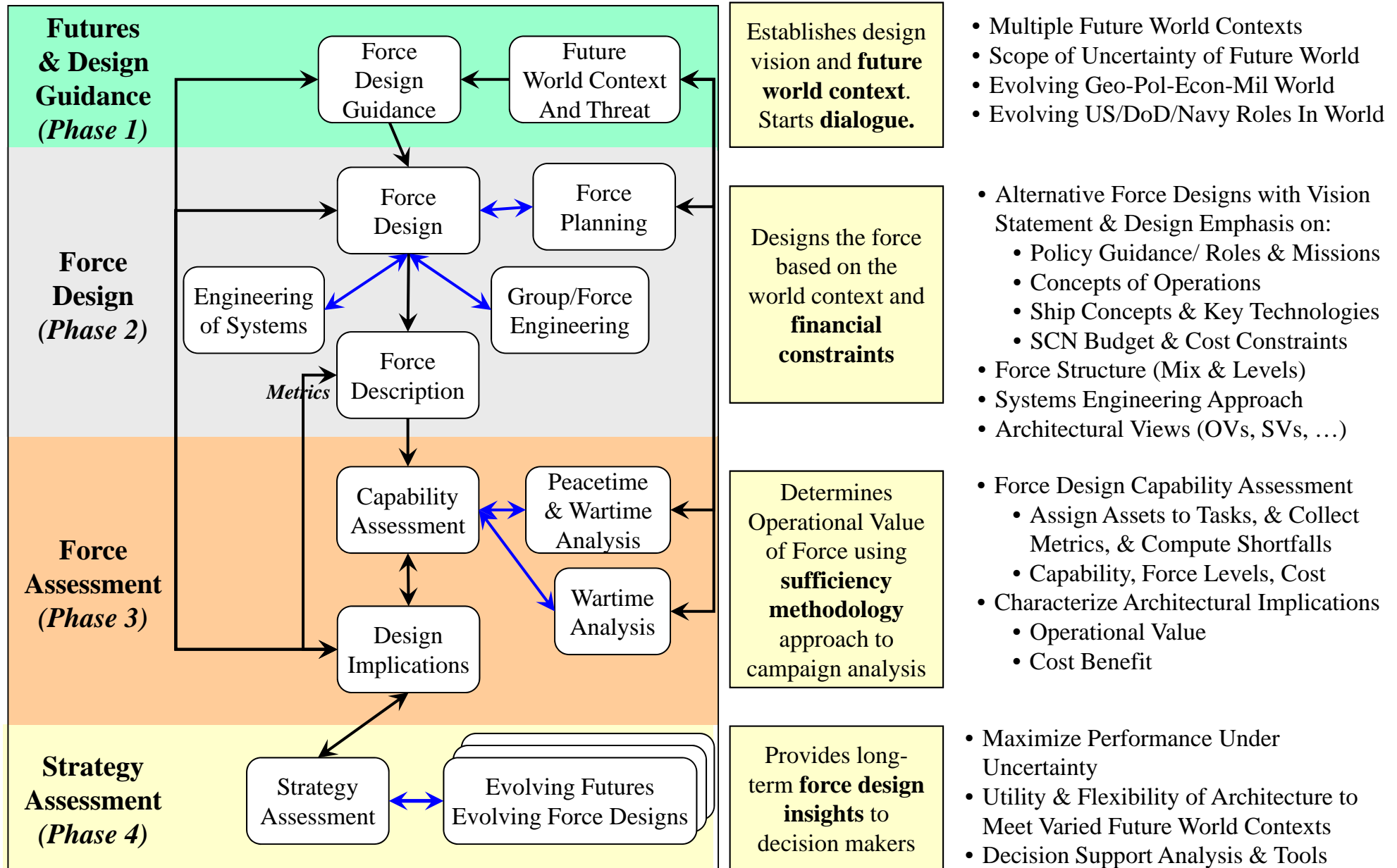
Designs the force based on vision statement, world context, and financial constraints  
Systems Engineering Approach

## (3) Force Assessment

Determines capacities and operational value of force  
Sufficiency methodology approach to campaign & mission analysis

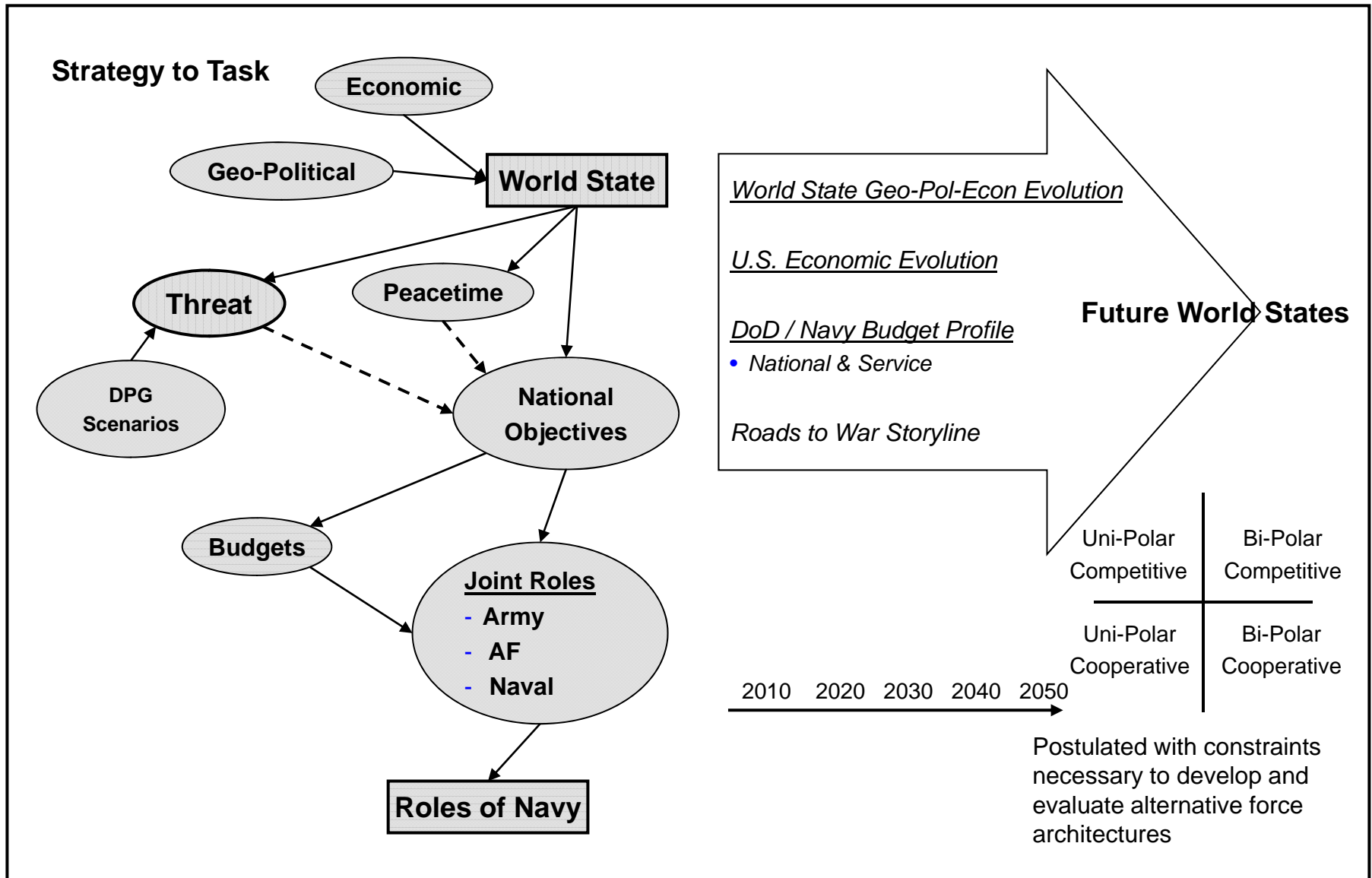
- Long-term force level perspective
- Each Phases identifies driving factors and metrics.
- Maintain force level scope and fidelity within each phase is essential.
- Methodology must be flexible (varied studies) and repeatable (evolving force designs, futures, and assessments).
  - iterative & recursive.

# Strategic Force Analysis Methodology





# Futures & Design Guidance (Phase 1)



## ***Force Design Tasks (Phase 2)***

### **◆ Joint Service Evolution**

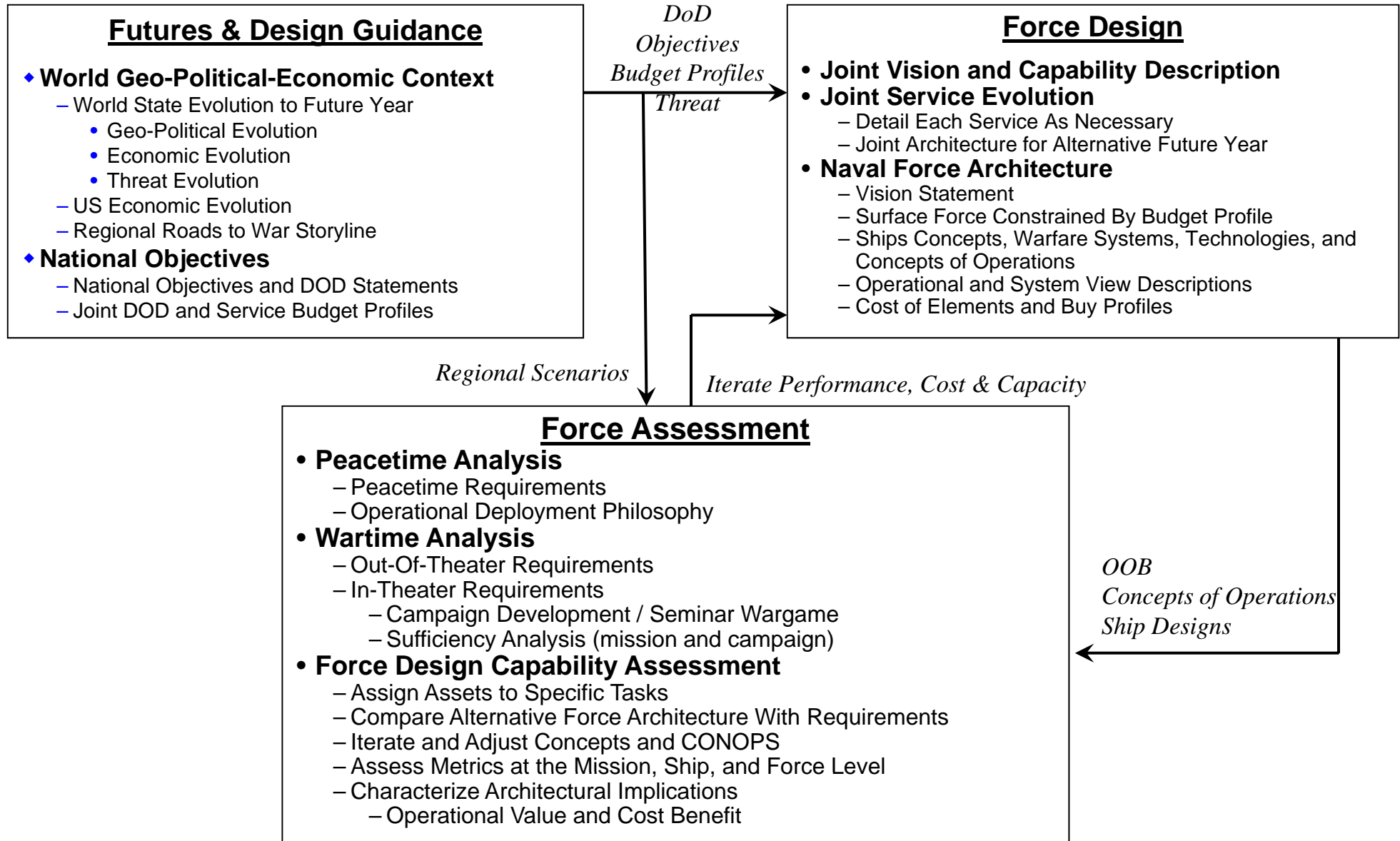
- Joint Service Vision and Capability Description
- Detail Each Service As Necessary
  - Army, Air Force, Marine, Naval, and Coast Guard
  - Service Roles, Organization, Inventory
- Joint Service Architecture for Future Year

### **◆ Naval Force Design**

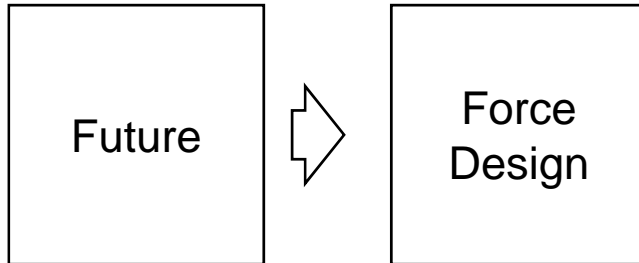
- Vision Statement
- Develop ship concepts, alternatives, and concepts of operation
- Develop technology roadmaps and combat system evolutions
- Basing, Logistics, and Support Philosophy
- Construct surface force structure constrained by alternative future
- Develop Operational View Descriptions
- Buy Profiles and Acquisition Strategies

# Force Assessment (Phase 3)

## An Iterative Approach

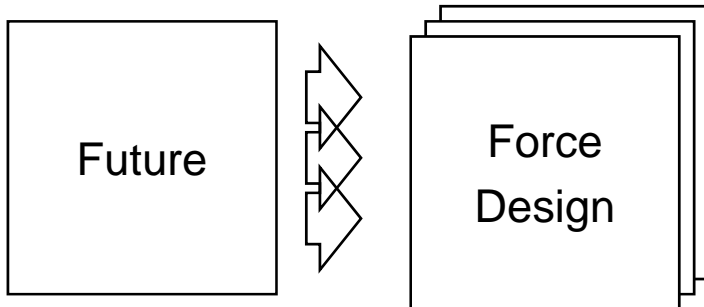


# Strategy Assessment (Phase 4)



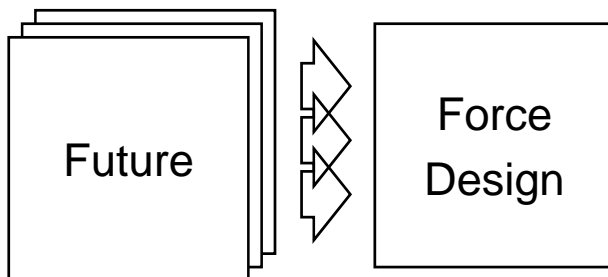
## Force Assessment

Operational value & cost benefit analysis  
capability, force level, cost



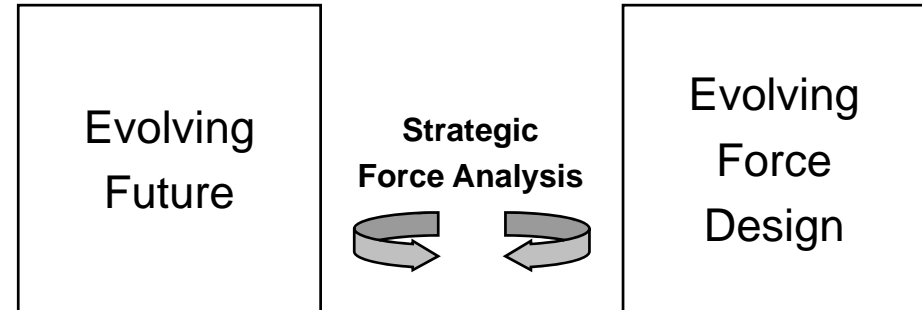
## Alternative Force Designs

Technology, Ship Concepts, Combat Systems, Cost



## Multiple Futures

Scope of un-certainty



## Strategy Assessment

- Maximize Performance Under Uncertainty
- Utility and Flexibility of An Architecture To Meet Requirements of Varied Future World Contexts
- Technology Investment Strategies

## Naval Force Structure

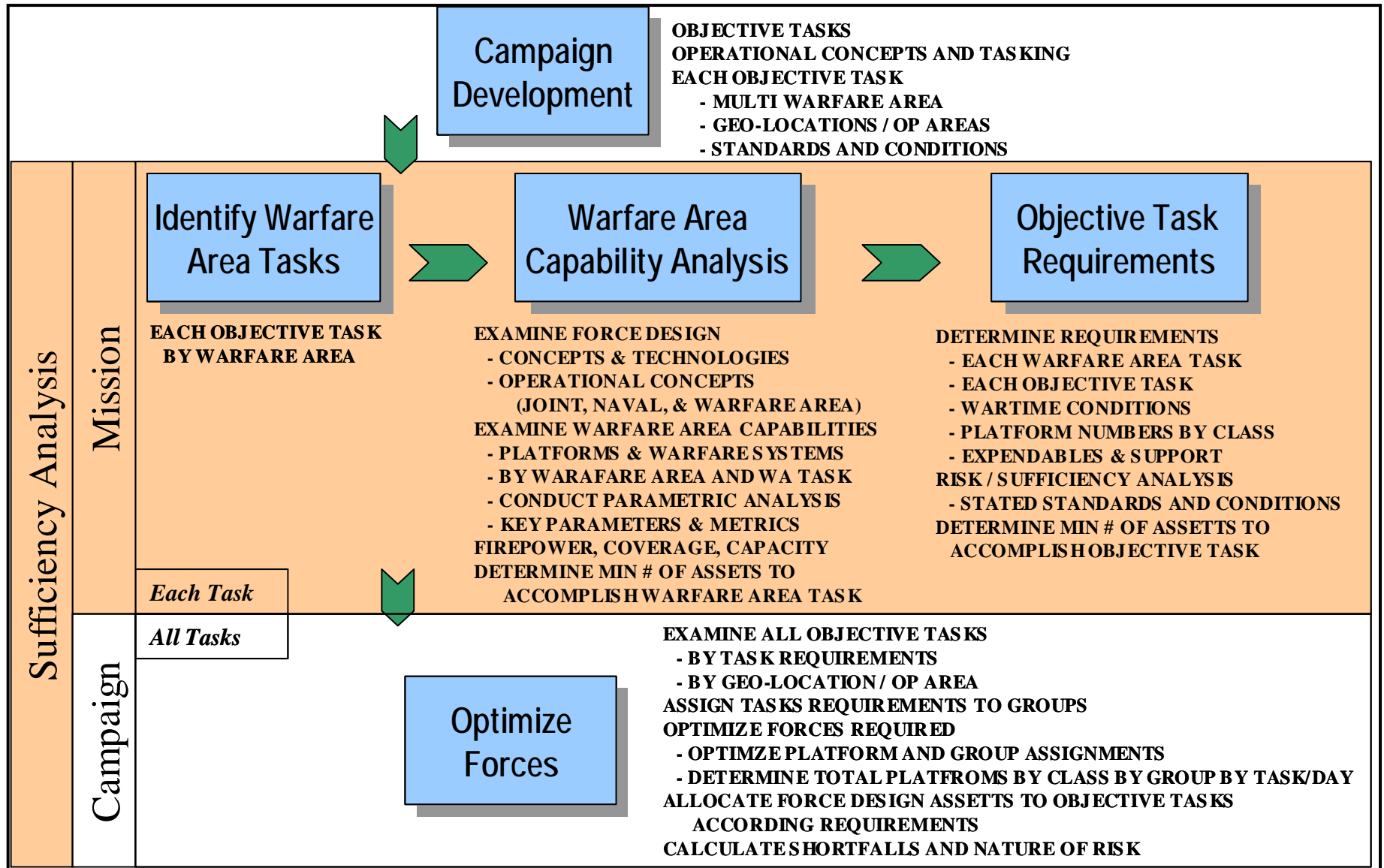
## Decision Support Analysis & Tools

- Need for Analysis Rigor. Focus on process, tools, data, and increased insight
- Force level analysis tools and process focus
- Maintain shipbuilding plans & databases for technology, combat systems, ship concepts, etc.
- Focus on force level spirals v. specific studies

# ***Force Assessment Key Elements***

- ◆ **Sufficiency Analysis**
- ◆ **Sufficiency Analysis Example**
- ◆ **Mission Capability Evolution Timelines**
- ◆ **Force Calculus**
- ◆ **Architecture Capability Assessment**

# Sufficiency Analysis





# Sufficiency Analysis Example

## Tasking Requirement: Peace Keeping

Objective Task	Objective Location	Warfare Area Tasks	Preferred Force
MS	SCS	ASW	SSN / Arrays / MPA
MS	IO	ASW	SSN / Arrays / MPA
MS	Makassar St	SUW, ASW, STK	CSG
MS	IO	SUW, ASW, STK	CSG
MS	UNCNF Zone 3	SUW, ASW, STK	CSG
PP	UNCNF West Coast Sumatra	STK, SOF, Amphib	MPG
LFP	Sea Base	Terminal	STK-SAG
LFP/SPOD	Banda Aceh	SUW, ASW, MIW, Amphib, Terminal	ESG
LFP/SPOD	Sorong	SUW, ASW, MIW, Amphib, Terminal	ESG
SLOC	St of Malacca	SUW, ASW, MIW, AAW	LCS, MIW Sqdrn
SLOC	Makassar St	SUW, ASW, MIW	LCS
SLOC	Sunda St	SUW, ASW, MIW	LCS
TFP	Sumatra	TBMD	TBMD-SAG
TFP	Java, Borneo	TBMD	TBMD-SAG
LFP	Medan	Terminal	DDG (AD)
LFP	Jakarta	Terminal	DDG (AD)

### Sufficiency Analysis Example

SLOC = Joint Mission  
ASW/MIW = Naval Task

- WMA analysis determines asset requirements  
ASW task = 5 Assets (LCS)  
SUW task = 5 Assets (LCS)
- Task analysis determines 7 assets (LCS) can do the combined SLOC task
- Campaign SA for I+15 determines asset requirements for all tasks = 26 LCS
- Force Flow (I+15) = 20 Platforms
- Force Design = 56 Platforms

Tasks identified by campaign snapshot and assessed using a **sufficiency analysis** technique

**CAMPAIGN TASKING SETS THE CONDITIONS FOR THE ANALYSIS**



# Warfare Mission Analysis

## Mission Capability Evolution Timelines

<b>AAW</b>	Extended range, precision fires.	Extended range, precision, high-volume fires.	-->	Increased range, volume Short flight-time multi-purpose missile.
<b>BMD</b>	Extended range, precision fires.	Extended range, precision, high-volume fires.	-->	Increased range, volume Short flight-time multi-purpose missile.
<b>MIW</b>	Extended range, precision fires.	Extended range, precision, high-volume fires.	-->	Increased range, volume Short flight-time multi-purpose missile.
<b>SUW</b>	Robust WTH Firepower SBs, PCs, & non-combatants	Long Range OTH Major combatants need for C4I and ID		Extremely High Power Capability Lasers, etc.
<b>STK</b>	Extended range, precision fires.	Extended range, precision, high-volume fires.	-->	Increased range, volume Short flight-time multi-purpose missile.
<b>ASW</b>	Group Centric ASW Search Ships, Subs, A/C, acting as nodes	OPAREA ASW Search Ships, Subs, A/C, acting as nodes		Theater ASW Operations Ships, Subs, A/C, acting as nodes
	SSN, DDC sensors and weapons	SSN, DDC sensors and weapons		Intelligent Sensors as Nodes
	SSN sensors and weapons	All Weapons as Nodes		Intelligent Weapons as Nodes
	Layered Defense			
	Search by Division of Area			
		Defense in depth	ASW Risk Management	
	Current	2010	2020	2030

Migration to off-board sensors, UUV, and integrated ASW picture

Backcasting technology development

**CG(X) Class Cruiser 2040**

**DD**

Capabilities:

Functional Loadout	Cells
ASW (SST & SSM)	0
SM & MR	8
ESSM (Quad-Pak)	10
Land Attack	26
YLA	6

**VTOL Heavy Cargo Quad Tilt Rotor 2040**

**Characteristics:**

**Payload:** 20 Tons

**Range:** 500 nmi (20 Tons), 2300 nmi. (Max)

**Engine Power:** 9566 shp

**Length:** TBD ft, **Height:** TBD ft

**Wingspan:** 90 ft

**Capabilities:**

- Lift:: Cargo:** Two 8X8X20 ISO Containers, One 8X8X40 ISO Container, Seven 463L pallets, Two 155 Howitzers, Three HMMWVs, 15

**ConOps:**

The primary missions for the VTOL Heavy Cargo Quad TiltRotor is to provide lift for combat assault of troops and their equipment in initial waves, amphibious operations

Technologies, systems, platforms, concepts of operations, operational concepts, and rules of engagement set the basis for analysis and establish evolution of capability



## ***Force Calculus Summary***

## Force Calculus Shortfalls/Overages

[illegible]

# Force Structure and Flows

Opt_01	Total_Force	10	0	14	24	56	0	68	0	54	10	0	20	3	18	0	0	0	10	0	12	16	0
	Crisis	2	0	2	5	12	0	20	0	16	3	0	4	0	0	0	0	0	2	0	0	0	0
	Civil War	2		2	5	12	0	26	0	16	3	0	4	0	0	0	0	0	2	0	0	0	0
	Civil War + 7	3		2	5	15	0	28	0	17	3	0	4	1	6	0	0	0	2	0	0	0	0
	Peace Keeping	4	0	4	6	20	0	30	0	18	3	0	4	2	12	0	0	0	2	0	0	0	0
	Peace Enforcement	4	0	4	6	20	0	30	0	18	3	0	4	2	12	0	0	0	2	0	0	0	0
Opt_02	Total_Force	10	0	10	0	52	14	0	78	50	10	0	0	0	0	31	10	16	5	0	0	0	0
	Crisis	1	0	1	0	7	3	0	24	14	3	0	0	0	0	2	0	1	0	0	0	0	0
	Civil War	1	0	2	0	7	4	0	30	14	3	0	0	0	0	2	0	1	0	0	0	0	0
	Civil War + 7	2	0	2	0	15	5	0	30	16	3	0	0	0	0	7	2	3	1	0	0	0	0
	Peace Keeping	4	0	2	0	19	7	0	30	18	3	0	0	0	0	7	3	4	1	0	0	0	0

# ***Architecture Capability Assessment***

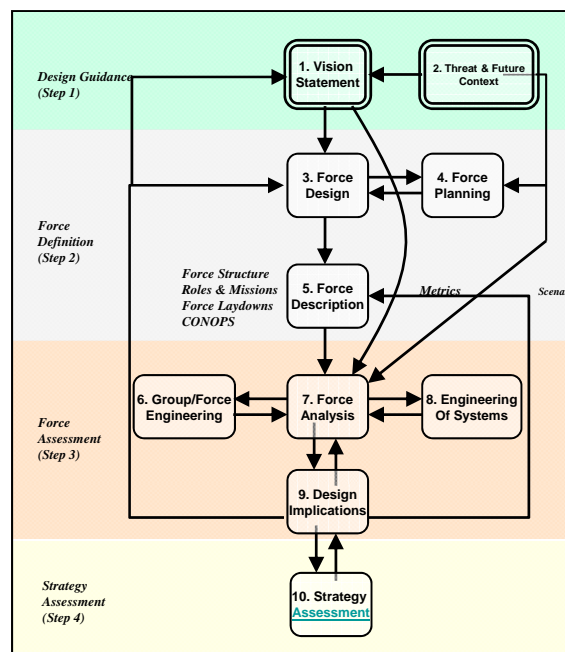
- ◆ **Collect Metrics for Baseline and Alternative Architectures**

- Mission Level
- Ship level
- Force level

- ◆ **Characterize Architectural Implications**

- In Terms Of Capability, Force Levels, and Cost
- Warfare Systems & Technologies
- Force Structure and Ship Concepts
- Cost Estimate and Overall Value
- Operational Philosophy

# Example: Future Force Formulation (F3) Summary Results



## Design Guidance

- World evolves to verge of multi-polar environment
- Global economy grows by 4x and seaborne trade by 6-8x. Resource scarcity significant.
- 8 potential areas of conflict in 2040

## Force Definition

- 2 Force design options – POR extended and FORCEnet/ Seabase. Both within cost construct (3% GDP growth).
- Technology roadmap and FORCEnet development
- FORCEnet gain not realized and automated ship concept introduced

## Force Assessment

- Neither force design stressed
- More escorts required for both designs due to dispersed operating areas
- Option 2 greater potential for technological growth

## Strategy Assessment

- Validated need for platforms
- Raised issues of long-term shipbuilding plan and build rates
- Identified potential gains in performance and reductions in cost if FORCEnet fully implemented
- Highlighted critical importance of long-range vision

Multiple future  
World Contexts &  
Economic  
Constraints

Systems  
Engineering  
Approach to  
Force Design

Sufficiency  
Analysis &  
Technology  
Roadmaps

Examination of  
Acquisition  
Implications

# ***Strategic Analysis of Naval Force Structure***

## **Tools and Models**

# ***Tools and Models***

- ◆ **Force Structure Analysis Model (ForceSAM)**
  - Analysis toolkit of legacy Force Structure and Affordability models
  - Broad, consistent, and integrated treatment of information & tools
- ◆ **ForceSAM contains models, tools, and processes:**
  - Force Acquisition & Inventory Model (FAIM) – Ship Acquisition Strategy model
    - Overview and Operation
    - Standard Products:
      - SCN Sandcharts; Bug Tables; Summaries by Ship Category
      - Shipbuilding Profiles (Procurement, Inventory, & Retirement Tables)
      - Shipyard Loading (open source data, scoped to support long range planning)
  - eXtended Platform Interface (XPI) – Force Level Capacity Analysis
    - Tailored Group Analysis and Fleet Comparisons
  - Maintenance, Modernization, & Repair (MMR)
  - Ship Yard Loading Module
- ◆ **Other**
  - Force Design & Presence Model; Fleet Affordability Model
  - Force Presence Model & Surge Model; Force Calculus Tools
  - Fleet Steady State Analysis

# ***FAIM Scope & Theme***

## ◆ **Scope:**

- Scoped to address factors driving strategic long range planning
- Models Entire Naval Force Levels, SCN, and Interactions
  - Integrated Ship Inventory and Budget Talley are the core elements
  - Repository of historical and current ships
- Primary Components:
  - Naval legacy: Inventory and planned retirement schedule
  - Shipbuilding plan: SCN procurement, retirements, cost, and schedule
- Supports Long Range Strategy and Provides Insight for Decision Makers
  - POM Baselines and Excursions

## ◆ **Theme – Integrated Process & Tools**

- Support OPNAV force level drills (bug tables, SCN Sandcharts, etc.)
- Provide High Overall Utility and Flexibility for the Analyst
- Inventory and retirement management at hull level
- Modular Workbook Construction of Legacy Ships and Ship Building Plans (inventory and retirement management at the hull level)
- Consistent Reporting of Reports and Charts
- Excel look & feel with dynamic updates of analyst inputs
- Local and network capable

# Long Range Shipbuilding Strategy

## Develop & Examine Ship Acquisition Strategies

- Develop Alternative Ship Acquisition Strategies
- Analysis trade-space for senior leadership
- Iterate Alternatives to Optimize / Tailor
- Assessing risk; balancing capability, cost, and industrial base

### Capability

- **Requirements**
- **Force Structure**
  - **CONOPS**
    - Fwd Deployment
    - MCO's & GWOT
- **Force Assessment**
  - Utility & Flexibility
  - Fire Power, Coverage, & Capacity

### LRS Strategy

- Balance the Tenets
- Nature of Future Force
- Spectrum of Threat
- Methods & Tools

### Industrial Base

- Nuclear Base
- Ship Yard Loading
- Skill Levels
- Stable Rates
- Surge Capacity

- **Ship Design**
  - Cost Targets
  - Capability v. Cost
- **SCN Budget Goals**
- **Procurement Policy**
  - Stable Rates
  - Efficient Runs

### Procurement Profile & Cost

# FAIM: Inflation / Deflation Tables

FAIM: Inflation / Deflation Tables															
16	<== Selected OSD Budget Year Index (BYI) Table														
15	<== Selected SCI Budget Year Index (BYI) Table														
			FYDP Planning								Capability Planning				
Scenario	Budget Factors	SBP Factors	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
13	(Realistic SCN)														
	[BudgetGoal]	TY\$M	15100.0	15680.1	16259.6	16833.2	17422.3	18033.1	18666.8	19324.7	20006.8	20713.1	21444.3	22201.24533	22984.94929
	[BudgetGoal]	CY\$M	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0
	[Deflation]	[CONVRATIO]	1.0000	0.9630	0.9287	0.8970	0.8667	0.8374	0.8089	0.7814	0.7547	0.7290	0.7042	0.6801	0.6570
	[Inflation]	[INFLATION]	1.0000	1.0384	1.0768	1.1148	1.1538	1.1942	1.2362	1.2798	1.3250	1.3717	1.4201	1.4703	1.5222
	Tina driven inflation index FY51 to FY70														
14	(OSD SCN)														
	[BudgetGoal]	TY\$M	15100.0	15402.0	15710.0	16024.2	16344.7	16671.6	17005.1	17345.2	17692.1	18045.9	18406.8	18774.95206	19150.4511
	[BudgetGoal]	CY\$M	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0	15100.0
	[Deflation]	[CONVRATIO]	1.0000	0.9804	0.9612	0.9423	0.9238	0.9057	0.8880	0.8706	0.8535	0.8368	0.8203	0.8043	0.7885
	[Inflation]	[INFLATION]	1.0000	1.0200	1.0404	1.0612	1.0824	1.1041	1.1262	1.1487	1.1717	1.1951	1.2190	1.2434	1.2682
	Tina driven inflation index FY61 to FY70														
15	(Realistic SCN)														
	[BudgetGoal]	TY\$M	16371.0	17000.0	17628.3	18250.1	18888.7	19551.0	20238.1	20951.3	21690.9	22456.6	23249.3	24069.99951	24919.67049
	[BudgetGoal]	CY\$M	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0
	[Deflation]	[CONVRATIO]	1.0384	1.0000	0.9644	0.9315	0.9000	0.8695	0.8400	0.8114	0.7837	0.7570	0.7312	0.7063	0.6822
	[Inflation]	[INFLATION]	0.9630	1.0000	1.0370	1.0735	1.1111	1.1501	1.1905	1.2324	1.2759	1.3210	1.3676	1.4159	1.4659
	Tina driven inflation index FY51 to FY70														
16	(OSD SCN)														
	[BudgetGoal]	TY\$M	16666.7	17000.0	17340.0	17686.8	18040.5	18401.3	18769.4	19144.8	19527.7	19918.2	20316.6	20722.90514	21137.36324
	[BudgetGoal]	CY\$M	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0	17000.0
	[Deflation]	[CONVRATIO]	1.0200	1.0000	0.9804	0.9612	0.9423	0.9238	0.9057	0.8880	0.8706	0.8535	0.8368	0.8203	0.8043
	[Inflation]	[INFLATION]	0.9804	1.0000	1.0200	1.0404	1.0612	1.0824	1.1041	1.1262	1.1487	1.1717	1.1951	1.2190	1.2434
	Tina driven inflation index FY61 to FY70														

Shipbuilding indices are unique based on tailored industry data, “Realistic” composite rates.

Inflation / deflation method are critical to calculating correct SCN

\* SCI deflated / OSD Inflated



# FAIM: Force Level Ship Costs

## “Ship Cost Projection” Method

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2	<b>FAIM: Procurement Profiles (SCN Line Item vs. SCN average cost, procurement shift, and procurement distribution)</b>																
3																	
4							<b>Procurement Profile as Percentage of Total Average Cost of Ship</b>										
5	<b>Ship Class</b>						<b>Procurement Years %</b>										
6	<b>Type</b>	<b>Class</b>	<b>FAIM Line Item</b>	<b>SCN</b>	<b>ConstDelay</b>	<b>ESL</b>	<b>AP6</b>	<b>AP5</b>	<b>AP4</b>	<b>AP3</b>	<b>AP2</b>	<b>AP1</b>	<b>PY1</b>	<b>PY2</b>	<b>PY3</b>	<b>PY4</b>	<b>PY5</b>
7	CV	CVE	CVE	0	5	50			2%	5%	19%	6%	34%	34%			
8	CVN	CVN-21	CVN-21	10200	7	50			2%	14%	10%	6%	28%	22%	12%	6%	
9		CVN-21	CVN-21 Lead	10200	7	50			2%	14%	10%	6%	28%	22%	12%	6%	
10	CG	CG(X)	CG(X)	4600	7	35				8%	8%	4%	41%	39%			
11		CG(X)	CG(X) Lead	7041	7	35				3%	5%	4%	45%	43%			
12	CG	CG(X)	CG(X) Plus	2400	6	35							100%				
13		CG(X)	CG(X) Plus Lead	2600	6	35							100%				
14	DDG	DDG-1000	DDG-1000	2410	5	35							100%				
15		DDG-1000	DDG-1000 Lead 1	3000	6	35							100%				
16		DDG-1000	DDG-1000 Lead 2	3000	7	35							100%				
17		DDG(X)	DDG(X)	1975	5	40						1%	99%				
18		DDG-51	DDG-51	1400	4	40						2%	98%				
19		DDG-51	DDG-51 Flt IIA	1765	4	40							100%				
20		FSC	FSC	1985	4	40						2%	98%				
21	LCS	LCS	LCS	480	3	25							100%				
22		LCS	LCS Lead	250	3	25							100%				
23		LCS	LCS(X)	400	3	25							100%				
24		LCS	LCS(X) Lead	750	3	25							100%				

Nominal distribution of Ship Costs by ship class

# FAIM: Primary Shipbuilding Interface

## Principle Shipbuilding Model for Navy

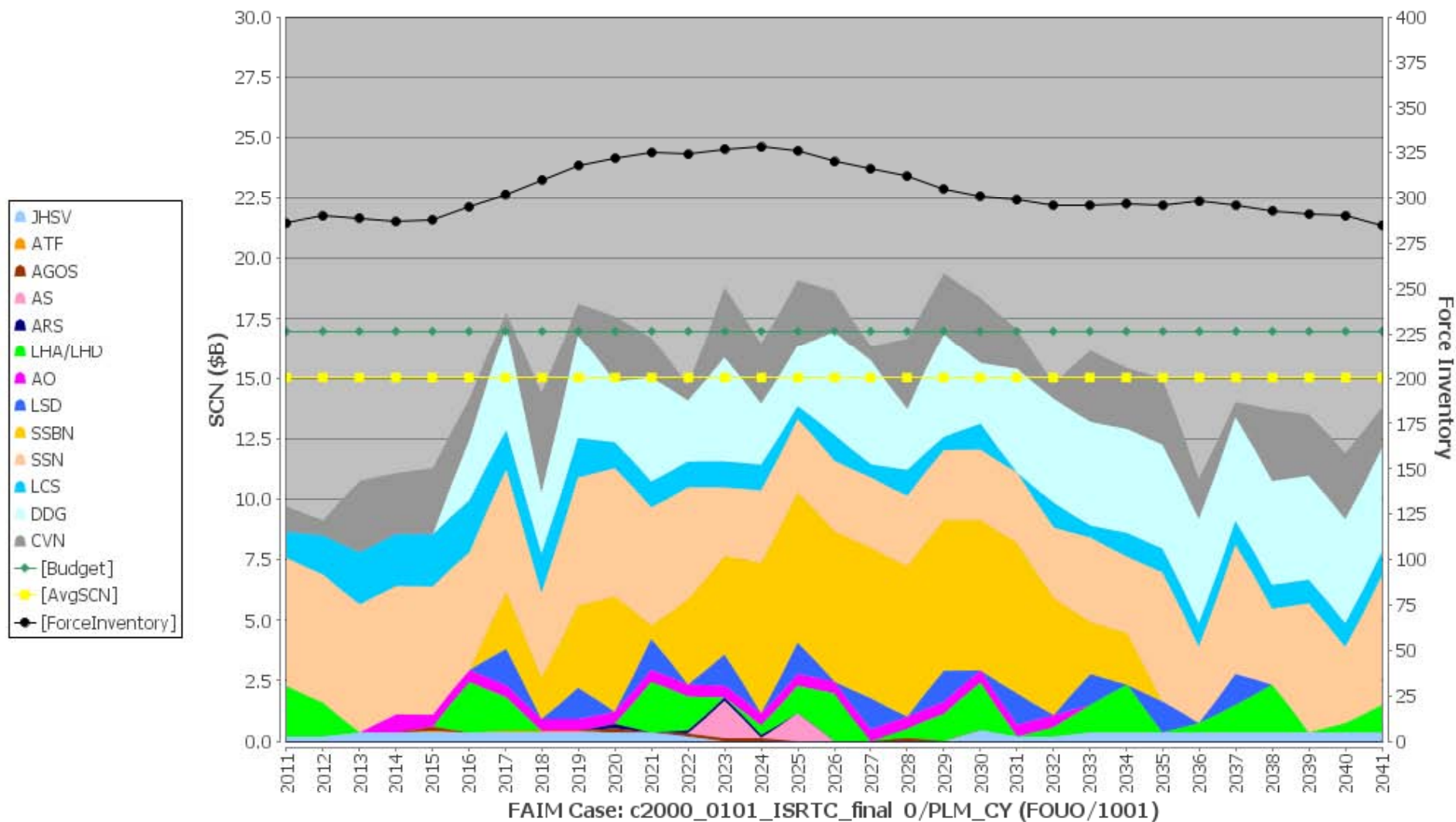
Ship Classification			Ship Factors				FAIM	FYDP							Capability Pla	
Category	Type	Class	FAIM Line Item	Comm	ESL	PSL	Factors	2011	2012	2013	2014	2015	2016	2017	2018	
Amphib	LPD	LPD-17	LPD-17	2005	40	40	Legacy	7	8	9	10	11	12	13	14	
Legacy Force			LPD-18	2007	40	40		5	6	7	8	9	10	11	12	
			LPD-19	2007	40	40		5	6	7	8	9	10	11	12	
			LPD-20	2008	40	40		4	5	6	7	8	9	10	11	
			LPD-21	2009	40	40		3	4	5	6	7	8	9	10	
			LPD-22	2011	40	40		1	2	3	4	5	6	7	8	
			LPD-23	2012	40	40			1	2	3	4	5	6	7	
			LPD-24	2012	40	40			1	2	3	4	5	6	7	
			[ClassCommisioned]			[Commisioned]			1	2	0	0	0	0	0	0
[ClassRetired]			[Retired]			0	0	0	0	0	0	0	0			
[ClassInventory]			[Inventory]			6	8	8	8	8	8	8	8			
Amphib	LPD	LPD-17	LPD-17			Procured		1								
Acquisition Plan			Procurement Cat => New	Shift => 4			Commisioned									
			Procurment Type => Ship	ESL => 40			Retired									
			Planning Method				AveShip_CY									
							APandOther									
			Cost Analyst Methods				PLM_CY	100.0	1700.0							
							PLM_TY	100.0	1800.0							
					CAM1	CAM1_TY			1800.0							
						CAM1_CY			1700.0							
			CAM2		CAM2_CY			0.0	1700.0	0.0	0.0	0.0	0.0	0.0	0.0	
					CAM2_TY			1856.0								
[ClassProcured]			[Procured]			0	1	0	0	0	0	0	0			
[ClassCommisioned]			[Commisioned]			0	0	1	0	1	1	0	0			
[ClassRetired]			[Retired]			0	0	0	0	0	0	0	0			
[ClassInventory]			[Inventory]			6	8	9	9	10	11	11	11			

*Influence Naval Force Structure (what we buy, how many, & capability delivered)*

# FAIM: Example Output

## SCN v. Naval Force Sandchart

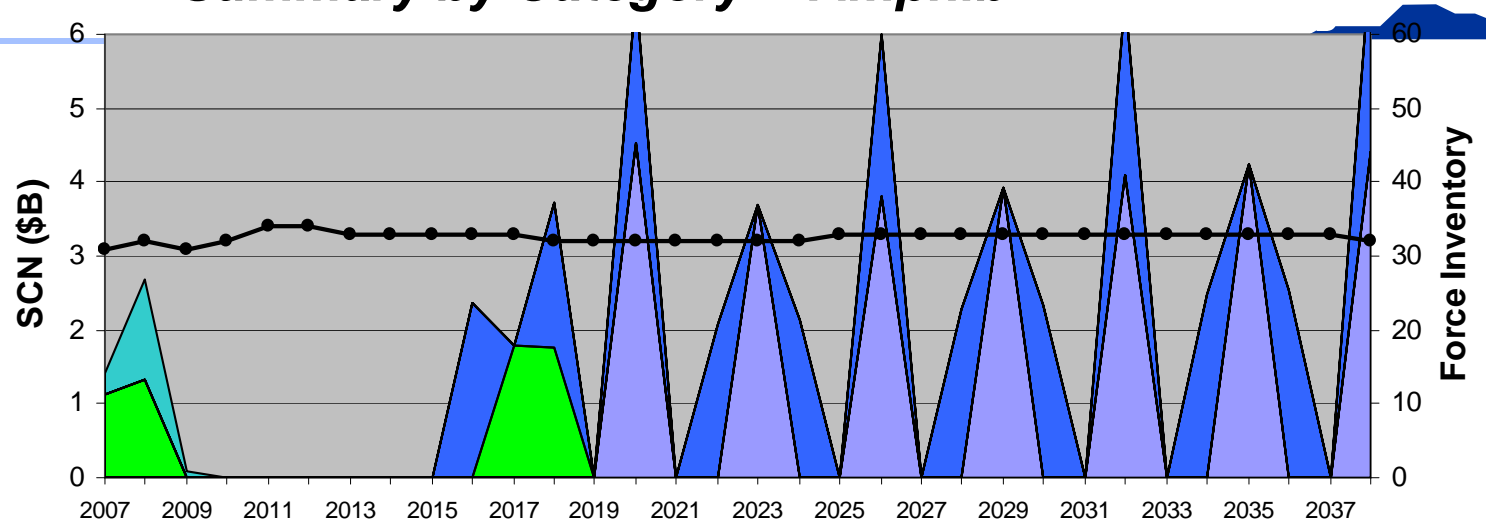
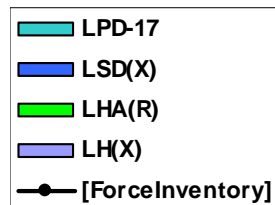
ct\FAIMSCNvsSFView: FAIM Case: c2000\_0101\_ISRTC\_final 0\PLM\_CY (FOUO/1001)



FOUO // 17 row(s) // 32 col(s)

# FAIM: Example Output

## Summary by Category -- Amphib



				7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Amphib	LPD	[Procured]	LPD-17		1																														
	LSD	[Procured]	LSD(X)										1		1		1		1		1		1		1		1		1		1		1		1
	LHA/LHD	[Procured]	LHA(R)	1										1																					
			LH(X)														1			1			1			1			1			1			1
Total				1	1								1	1	1		2		1	1	1		2		1	1	1		2		1	1	1		2

				7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Amphib	LPD	[Retired]	LPD-4	-3		-2			-2	-1					-1																				
		[Delivered]	LPD-17	2	1	1	1	2	1																										
		[Inventory]	LPD-4	6	6	4	4	4	2	1	1	1	1	1																					
			LPD-17	3	4	5	6	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
	LSD	[Retired]	LSD-41																				-1	-1	-1	-1		-2	-1		-1		-1		
		[Delivered]	LSD(X)																1	1		1		1		1		1		1		1		1	
		[Inventory]	LSD-41	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	8	6	6	5	5	4	4	3	3
			LSD(X)																1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9
	LHA/LHD	[Retired]	LHA-1	-1		-1													-1	-1															
			LHD-1																												-1			-1	-1
		[Delivered]	LHD-8			1																													
			LHA(R)						1										1																
			LH(X)																			1		1			1			1				1	
		[Inventory]	LHA-1	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	1																
			LHD-1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	5	4
			LHD-8			1	1	1	1	1	1	1	1	1	1	1	1	1																	
			LHA(R)						1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
			LH(X)																			1	1	2	2	2	2	3	3	3	4	4	4	5	5
Total				31	32	31	32	34	34	33	33	33	33	33	32	32	32	32	32	32	32	33	33	33	33	33	33	33	33	33	33	33	33	33	32



# FAIM: Example Output

## Force Inventory v. Requirements Bug Table

BFRReqBug1		07	08	09	10	11	12	13	14	15	16	17	18	19	20	Req	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
Carrier	CV	1	1					0	0							11																		
	CVN	10	10	11	11	11	11	10	10	11	11	11	11	12	12		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
	Total	11	11	11	11	11	11	10	10	11	11	11	11	12	12	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
Surface Co	FFG	30	30	30	29	29	26	21	13	6	3	1	1			0																		
	CG(47)	22	22	22	22	22	22	22	22	22	22	22	22	22	22	19	21	18	16	14	11	7	4	1										
	CG(X)											1	1	2	3		7	9	11	13	15	17	18	19	19	19	19	19	19	19	19	19		
	DDG-51	52	53	57	60	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	61	61	60	56	51	45	41	
	DDG(X)																						1	1	3	6	9	12	15	18	21	24	27	
	DDG-1000							2	2	4	5	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
	LCS		2	2	2	2	3	8	11	14	18	24	30	36	42	55	41	54	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	
	Total	104	107	111	113	115	113	115	110	108	110	116	123	129	136	143	148	148	149	149	148	146	146	144	146	149	151	154	156	155	153	150	149	
Sub	SSN	53	52	53	52	52	53	54	51	51	49	50	49	50	49	48	48	47	47	46	45	44	43	41	41	41	43	43	43	43	43	43	43	
	SSN-774(X)																	0	0	0	0	0	0	0	0	1	1	2	4	6	7	9	10	
	SSGN	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	1	0	0	0	0	0	0	0	0	0	0	
	SSBN	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	13	13	13	12	12	12	12	12	12	12	12	12	
	Total	71	70	71	70	70	71	72	69	69	67	68	67	68	68	66	66	65	65	64	63	60	57	54	54	54	56	57	59	61	62	64	65	
Amphib	LPD	9	10	9	10	12	11	10	10	10	10	10	9	9	9	10	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	
	LSD	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	13	14	14	15	14	14	13	13	13	12	12	12	12	12	12	12	
	LHA/LHD	10	10	10	10	10	11	11	11	11	11	11	11	11	11	9	11	10	9	9	9	10	10	11	11	11	12	12	12	12	12	12	12	
	Total	31	32	31	32	34	34	33	33	33	33	33	32	32	32	31	32	32	32	32	33	33	33	33	33	33	33	33	33	33	33	33	33	
CLF	T-AFS	5	3													0																		
	T-AO	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15		
	T-AOE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		
	T-AE	5	5	5	3											0																		
	T-AKE	3	5	8	9	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
	Total	31	31	31	30	28	29	29	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	
Mine	MHC/MCM	14	14	14	14	14	14	14	14	14	14	13	13	11	10	0	7	6	2	1														
	Total	14	14	14	14	14	14	14	14	14	14	13	13	11	10	0	7	6	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
MPF(F)	LHA/LHD															3	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
	MPFA									1	1	1	1	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	MPFD									2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	MPF(F) T-AKE							1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	MPFC											1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Total	0	0	0	0	0	0	1	1	2	4	6	7	9	12	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
Cmd & Sup	T-ARS	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	AS	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	T-AGOS	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
	JHSS															1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	T-ATF	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	Command	2	2	2	2	2	2	2	2	2	3	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	JHSV						1	2	3	4	5	6	7	7	7	3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
	Total	17	17	17	17	17	18	19	20	21	22	24	26	24	24	20	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Total		279	282	286	287	289	290	293	287	288	291	301	309	315	319	313	323	327	324	322	320	315	312	307	309	312	316	320	324	325	324	323	323	

16.1:5.0:2008030464126 Legend: White: In Transition Red: Below 2020 Requirement Green: Meets 2020 Requirement Purple: Exceeds 2020 Requirement

Assess impact of shipbuilding plan to meeting established force level requirements

# FAIM Analysis Take Aways

## ◆ Thousand moving pieces

- Legacy, Retirements, Procurements, & Commissions
- Design scope is for 7-30+ year window
  - Budget fidelity in FYDP to ship cost “projections” for mid- & far-term
- Procurement strategies within class and across fleet for 300 ships

## ◆ Factors that drive analysis and response time

- Changes to cost, procurement schedule, retirements
  - Quick for a given run or excursion from baseline
  - Alternative shipbuilding plans easily developed
- Increased fidelity and detail increase level of effort (cost controls in FYDP)
  - Cost basis may effect multiple runs or baseline
  - Maintain configuration control over baselines and excursions

- Establish factors early and develop balanced shipbuilding plans using established criteria  
*ex. \$13B, \$15B, & \$17B balanced fleets)*

Versus

- Doing budget fidelity analysis in FYDP has impacts across upstream cases

# ***eXtended Platform Information (XPI)***

## ◆ **Force Level Capacity of Future Fleet Architectures**

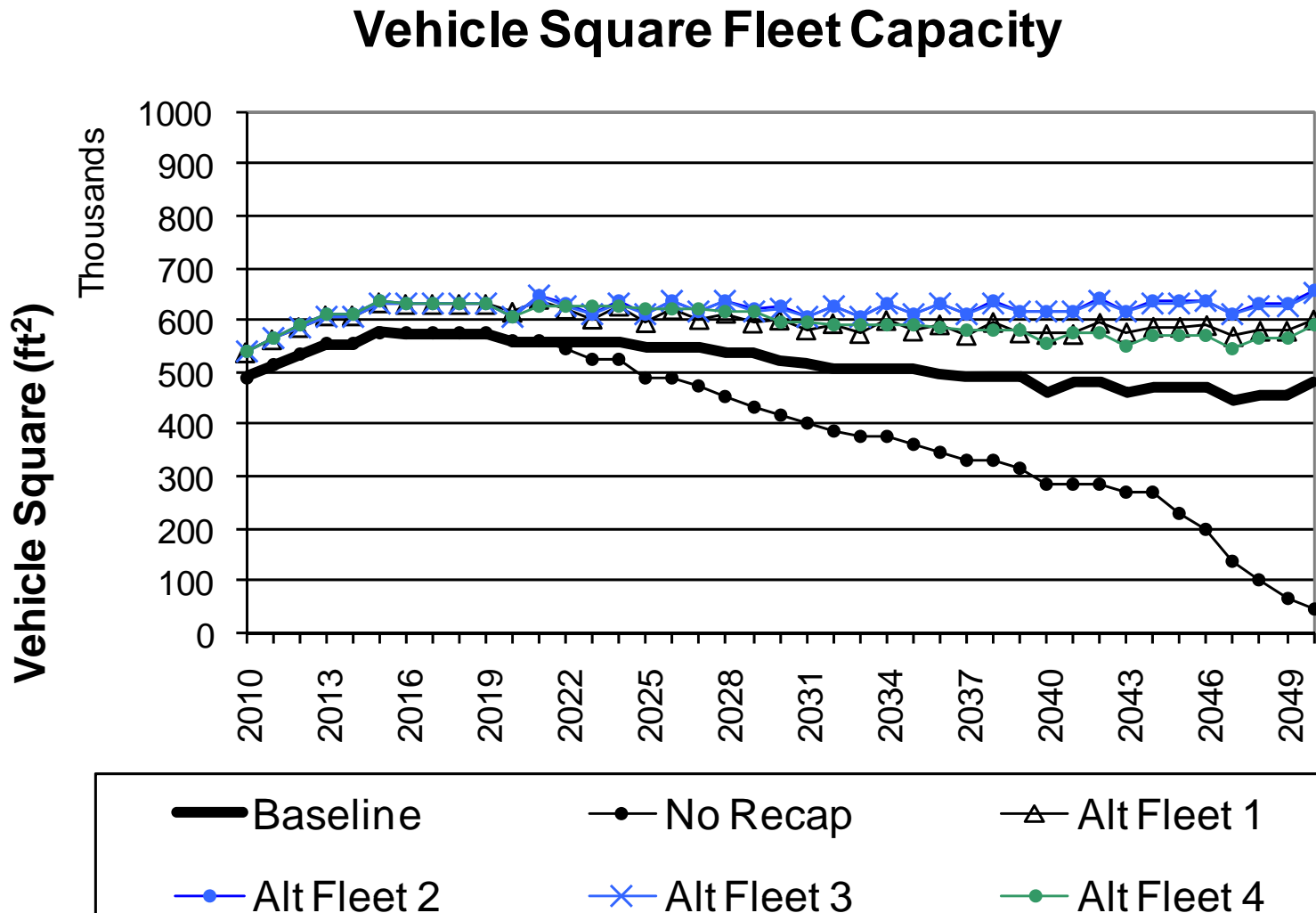
- Ship Characterizations for Ships & Ship Concepts
  - Capacities, performance, & dimensional data
  - Scoped to support force level analysis (i.e. at ship class)
- XPI is a module of ForceSAM with force structure input from FAIM
- Tied to FAIM for shipbuilding plan input
- Rapid evaluation of force structure changes

## ◆ **Identify and Configure Control Ship Feature Data**

- Supports library/database for 05D1 configuration control
- Supports studies/analysis with standing database



# XPI Report: Fleet Capacity Example



In progress: updating ship data / fleet capacities



# Summary

## ♦ **Strategic analysis is relevant to naval force structure analysis**

- Current events, global and national uncertainty
- Support OPNAV ship acquisition strategies
  - Long Range Shipbuilding Strategy (LRSS); Annual Report to Congress
  - AoA's & CBA's
- Supports need to make near term decisions

## ♦ **Flexible framework and consistent methodology**

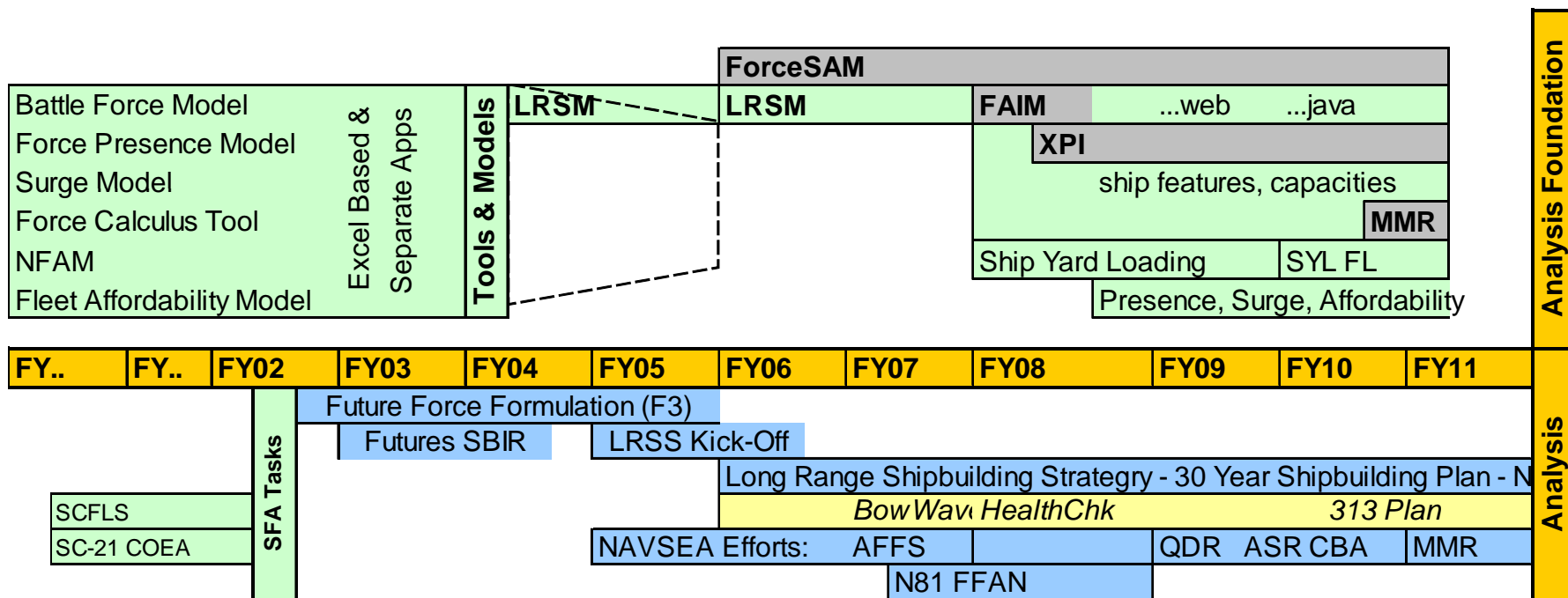
- Maintain the force level scope required to be responsive and provide value
- Hierarchical iterative across and recursive within phases as necessary
- Phases identify the force level areas and context
- Focus on key factors to provide clear insight into force architecture performance and value at the force level
- Sufficiency analysis focuses on firepower / coverage / capacity
  - Modular, stepwise elements; rapid iterations
- Conduct analysis and align with SMEs and Operational community
  - ship data, ship concepts, affordability, costing, force analysis

# NSWCDD Efforts and Alignment

## Influence Naval Force Structure

- What we buy
- How many
- Capability delivered

## Tool and Processes



## Support Various Force Structure Analysis

# *Way Ahead*

## ♦ **Continue to support NAVSEA and OPNAV studies**

- NAVSEA & Labs have unique assess and expertise
  - SMEs, combat systems, technology, ship concepts, cost, and force architectures
  - Tools and model development
  - Analysis rigor
- Continue to socialize Naval Force Structure Analysis and value to near-term decisions

## ♦ **Force level focus needed to provide decision support analysis, tools, expertise, and data**

- Focus on iteration of force designs and process improvement
- Develop force structure trade-space for senior leadership
- Maintain shipbuilding plans & databases for technology, combat systems, technology, ship concepts, and force architectures

# ***Backup Slides***

# ***Sufficiency Analysis Benefits***

- ◆ **Operational Analysis Input with Output expressed as Capability and Inventory Requirements**
- ◆ **Results Expressed in Terms Directly Useful to Acquisition Planning**
  - Ship Classes by Capability by Numbers Required
  - Utility and Flexibility of Design Features in Meeting Operational Tasking
- ◆ **Applies Warfare Area Expertise to Satisfy Operational Tasking**
  - ◆ Focus on Key Parameters that Drive Capability; Clear Insights
- ◆ **Broad Scope**
  - Evolving Roles and Missions; Long-term DoD Budget Profiles
  - Employment and Deployment Policies
  - Investment and Operation Costs
  - Peacetime and Wartime Requirements Analysis
- ◆ **Hierarchical Analysis Methodology**
  - Straightforward, Transparent Techniques
  - Modular, Stepwise Elements; Rapid Iterations, Easy Optimization

# Warfare Area Task Set

## ♦ Surface Warfare (SUW)

- Escort HVU
  - Through Choke Points, In Transit
- Protect Joint Operating Areas
  - Op Area
  - SLOC/Transit Lane
  - Protect Port
- Engage Surface Targets
  - Long Range, Short Range

## ♦ Air Warfare (AW)

- Forward Air Dominance / Establish Air Barriers
  - Outer Air Defense
  - LA Cruise Missile Defense
- Area Air Dominance
- Self-Defense

## ♦ Strike

- Strategic Strike
- Interdiction
- Fire Support

## ♦ BMD

- Theater BMD
- Area BMD

## ♦ Anti-Submarine Warfare (USW)

- Protect Forces In Transit
- Establish Barriers and Protect the JOA
  - Op Area
  - SLOC/Transit Lane
  - Port Protection
- Track and Trail/Attack Detected Targets (Subs & HVU's)
- Deliver SOF

## ♦ Mine Warfare (MIW)

- Escort Forces
  - Through Choke Points & SLOCs
  - In Transit
- Establish and Maintain Mine-Cleared Areas
  - SLOC/Transit Lane
  - Op Area
  - Port Protection
- Establish & Maintain Minefields
  - Op Area
  - Port Protection

# Warfare Area Task Matrix

Warfare Area	Warfare Area Tasks	Conditions				Standards	
		Threats	Environments	Dimensions	ISR Available	MOEs	Success Criteria
AAW	Cruise Missile Defense						
AAW	Outer Air Battle						
AAW	Terminal Defense						
ASW	Establish Barriers and Protect the JOA	Diesel Subs, SSN's	Water Depth, Salinity, White Traffic Density, Season	OpAreas: (30 x 30 nm); SLOCs: (200 x 0.5 nm)	Sensor Arrays	Pd	Pd = 0.90
ASW	Protect Forces In Transit	Diesel Subs, SSN's	Water Depth, Salinity, White Traffic Density, Season	Convoy: (5nm x 10nm)	Sensor Arrays	Pd	Pd = 0.90
ASW	Protect Ports	Diesel Subs, SSN's	Water Depth, Salinity, White Traffic Density, Season				
BMD	Area BMD					# of Leakers	
BMD	Theater BMD					# of Leakers	
MIW	Escort: Transit	Bottom, Moored, and Surface Mines	Water Clarity and Depth		Bottom Mapping, Undersea Sensor Array Detection of Mine-Laying Activity	time to clear area	7 days
MIW	Establish and Maintain Mine Cleared Areas	Top Moored, and Surface Mines	Water Clarity and Depth	OpAreas: (30 x 30 nm); SLOC/Transit Lane: (200 x 0.5 nm)	Bottom Mapping, Undersea Sensor Array Detection of Mine-Laying Activity	time to clear area	7 days

# Future Force Formulation

## Mission Analysis Highlights

- **For each warfare area** – Overall assessment of performance
- **Snapshot (D, D+3, D+10, D+30)** – Assessment of performance and adequacy of force flow
- **Force Level** – Overall assessment of performance and adequacy of force design
- **Comparative Analysis** – Comparison of cost, performance and adequacy of Option 1 and Option 2

	Option 1	Option 2
<b>Strike</b>	<ul style="list-style-type: none"> <li>♦ DDX with rail guns, manned AC and UV</li> <li>♦ Seabase supports Marines Ashore (ESG, CSG, MPF(F))</li> <li>♦ Fire support and Interdiction required 1DDX and ½ CVN</li> <li>♦ 50% SAM sites still up 2<sup>nd</sup> day</li> </ul>	<ul style="list-style-type: none"> <li>♦ Battery ship with rail guns, Manned AC &amp; UV</li> <li>♦ Seabase supports Marines ashore (MNF -- CVN, DDG(AD), LES, LLP, &amp; Battery Ship)</li> <li>♦ Fire support and Interdiction required 1LES (TACAIR configured) &amp; 1 battery ship</li> <li>♦ Fn substantially reduces risk to A/C (4% SAM sites still up 2<sup>nd</sup> day)</li> </ul>
<b>TBM</b>	<ul style="list-style-type: none"> <li>♦ CG(X) and DDG(AD); req locations is force driver</li> <li>♦ 63 missiles fired, 5 leakers</li> <li>♦ Organic sensors and engagement</li> <li>♦ Sufficient missiles in theater</li> </ul>	<ul style="list-style-type: none"> <li>♦ CG(X) &amp; DDG(AD), required locations is force driver</li> <li>♦ 57 missiles fired, 0.6 leakers</li> <li>♦ Fn enabled DOF of 2 for mid-course defense</li> <li>♦ Sufficient missiles in theater</li> </ul>
<b>AAW</b>	<ul style="list-style-type: none"> <li>♦ SM-6 and SM-2 follow-on missiles</li> <li>♦ 119 missiles fired, 17 ASCM leakers in area AD</li> <li>♦ Organic sensors and engagement (DOF of 1)</li> <li>♦ Sufficient area AD missiles in theater</li> </ul>	<ul style="list-style-type: none"> <li>♦ Extended range, pass-forward concept w/SM-6 for outer air battle freeing manned AC</li> <li>♦ 104 missiles fired, 6 ASCM leakers in area AD</li> <li>♦ Fn enabled DOF &gt; 1 except for ASCM category</li> <li>♦ Greater detection and higher Pk when DOF=1</li> <li>♦ Sufficient area AD missiles in theater</li> </ul>
<b>ASW</b>	<ul style="list-style-type: none"> <li>♦ UV control from LCS</li> </ul>	<ul style="list-style-type: none"> <li>♦ UV control from LCS</li> <li>♦ Fn comms and control enables wider separation of UV's reducing LCS requirements</li> </ul>
<b>SubW</b>	<ul style="list-style-type: none"> <li>♦ Decentralized UV control results in need for more LCS platforms</li> <li>♦ Small boats and high vol white shipping concerns</li> <li>♦ Small boat "breakout" detected by organic sensors</li> <li>♦ UV spacing 8 nmi apart</li> </ul>	<ul style="list-style-type: none"> <li>♦ Centralized UV control reduces LCS platform requirements</li> <li>♦ Small boats and high vol white shipping concerns</li> <li>♦ Fn enables quicker/more effective response w/UVs</li> <li>♦ UV vehicles spacing 12.5 nmi apart</li> </ul>
<b>MineW</b>	<ul style="list-style-type: none"> <li>♦ Navigation accuracy 7m</li> <li>♦ False targets 8 per nmi<sup>2</sup></li> <li>♦ Mine clearance requires days</li> </ul>	<ul style="list-style-type: none"> <li>♦ Navigation accuracy 2 m</li> <li>♦ False targets 2 per nmi<sup>2</sup></li> <li>♦ Greater endurance reduced MCM unmanned vehicles requirements by a factor of 4.8</li> <li>♦ Mine clearance requires hours with pre-positioned sensor field</li> </ul>